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ABSTRACT

A cross-cultural study undertaken in Morocco was designed to compare the effects of age, schooling and environment on the development of recall and recognition memory. The subjects were 384 males ranging in age from 7 to 21 years. Additional groups of subjects were also studied: Koranic students, Moroccan rug sellers, and American university students. Based on the model of memory of Atkinson and Shiffren (1968), it was hypothesized that structural features of memory may be less variable across cultures or lifetime experiences than control processes, which are known to vary with chronological age in educated Western subjects. The recall and recognition tasks were designed to tap both structural features and control processes in memory. Results showed that structural features, such as the capacity of echoic store (recall) and the rate of forgetting (recognition), were relatively invariant with age and experiential background. In contrast, control processes, such as verbal rehearsal (recall) and rate of acquisition (recognition), depended on such factors as schooling and urbanization. Finally, based on these and other data, it was hypothesized that there exist both universal and culture-specific aspects of memory and cognition. (Author)

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THE EFFECTS OF SCHOOLING, CULTURE AND ENVIRONMENT ON COGNITIVE DEVELOPMENT

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The topic of "universals" in human behavior has been controversial for psychologists, as well as for other social scientists. Empirical and anecdotal evidence from differing cultural groups has been used to both support and deny the notion of universals in psychological thought. In its most extreme form, anthropologists such as Lucien Levy-Bruhl (1966) have suggested that there was such a thing as "primitive mind," while others, such as Alfred Kroeber (1948) countered that there exists, in fact, a "psychic unity" of all mankind where no fundamental differences exist. Some investigators (e.g., Cole & Scribner, 1974) have suggested that cultural differences in behavior may be more apparent than real. Thus, the earlier contrasting views might be reconciled by claiming that cognitive differences may exist in content only (i.e., what different peoples think about), rather than in cognitive process (i.e., how people think about what they think about.). This sort of explanation is likely to gain substantial support from a variety of social science disciplines.

In fact, there is an increasing tendency to believe in universals in human cognition. The developmental psychologist has only to open any recent test on child development to find the topic of universals writ large. There

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is, indeed, a considerable body of evidence that suggests innate universal psychological processes. A few recent examples would include studies in linguistics and language development by Chomsky (1972), Lenneberg (1969), Slobin (1973), and others, as well as in the area of perception and perceptual development by Rosch (1973), T.G.R. Bower (1974) and many others. Both age-developmental and cross-cultural research has been used effectively by the above investigators to support the notion of cognitive universals.

Given the kind of evidence just mentioned, we may ask if it is reasonable to agree with such developmentalists as Kagan and Klein (1973) who, in their well-publicized Guatemala study, stated that "basic cognitive processes...such as perceptual analysis, language and memory...[are]...an inherent competence in the human program" (p.949). While the evidence on universals in perception and language has been fairly well documented, research on memory development has not, in spite of the fact that this area has been the subject of increasing interest in recent years. The present paper deals with the question of universals in human memory, and the potential effects of global cultural factors such as formal schooling and urbanization on memory development.

Before getting into the present data, however, it is useful to briefly outline the theoretical context in terms of theories of memory and memory development. One of the important conceptualizations of memory in recent years is that proposed by Atkinson and Shiffrin (1968). In this theory--which now includes a number of variants--memory is said to be composed of structural features and control processes. In such an information-processing model of memory, structural features include: sensory store; short-term store; and long-term store. Each of these stores has a relatively

fixed capacity and fixed decay rates. Control processes are what guide information through the system or structure, and are often (though not always) considered to be under the potential conscious control of the individual. These processes have also been termed strategies for remembering, or simply, mnemonics.

Research by developmentalists such as Brown (1975), Flavell (1970), Hagen (1971) and many others have provided a considerable body of evidence in support of such a model for studying memory in children. Structural features have been shown to be present very early in development, as evidenced by recognition memory studies with young children, where decay or forgetting rates have been found to be unchanging across age (e.g. Wickelgren, 1975). In short-term recall tasks, recency effects are present in very young children, and are also relatively invariant over age (e.g. Hagen, 1971; Wagner, 1974). Control processes, on the other hand, have been shown to increase with chronological age in children. Memory strategies such as rehearsal, clustering, categorization and semantic encoding have been shown in a wide variety of studies to increase developmentally (for a review, see Brown, 1975).

Given this developmental model with memory structure developing very early, while control processes develop more slowly through young and middle childhood, the standard environmentalist question may be asked: To what degree do environmental factors affect our model? To what extent are structure and control processes susceptible to environmental influence? Considering the research cited above, it might be reasonable to hypothesize that control processes would be considerably more sensitive to environmental events than structural features, which appear to be relatively stable from early childhood.

The Morocco Study

To gather evidence on these questions, a study was undertaken in Morocco where wide environmental variability within a single culture provided an ideal setting for studying such global factors as schooling and urbanization.

In the study, 384 children and young adults (all males), ranging in age from 6 to 22 years were selected in a design that contrasted schooled and non-schooled children in urban and rural environments. Additional groups of subjects--including Koranic school students, Moroccan rug sellers, and University of Michigan students--were also tested in order to study possible culture-specific influences on memory. Subjects were tested in their preferred languages by a bilingual Moroccan who served as the experimenter in all testing. In the two memory experiments, tasks were chosen because each tapped into specific aspects of structure and control processes.

Experiment I: Short-term Recall

The first experiment studied the development of short-term recall. This memory task, first used extensively by Hagen (1971) and his associates, required the subject to locate the position of a familiar animal in a series of seven briefly presented items, where the to-be-remembered item varied in position from trial to trial over 14 trials. The subject was first shown each of seven cards, which were turned face down after a two second presentation. Following the presentation, the subject was presented with a single "probe" card with a single animal on it, and had to find the same animal in the linear array of seven face-down cards. Since the results of this study and an earlier study are available elsewhere (Wagner, 1974, in press), only a brief discussion of the results will be presented here. There were two main

findings: first, recency recall (an indicator of short-term store) was present in stable form in all populations studied, regardless of age, schooling or environment; and second, primacy recall--considered to be a function of verbally mediated rehearsal strategies or control processes--developed with age only for schooled subjects. And, it appears that primacy recall was what causes improved overall short-term recall in the older schooled groups. While earlier studies have typically been hampered by the confounding of the factors of schooling and urbanization, the present study showed that each factor may have a positive effect on the development of control processes in memory. Thus, it appears that the use of mnemonic strategies may be tied to certain cultural experiences, while the recency effect--a structural feature of memory--seems to be present in all individuals regardless of age or special cultural experiences.

Experiment II: Recognition Memory

Models of recognition memory (e.g. Anderson & Bower, 1972; Kintsch, 1970) suggest that there are two primary parameters that determine recognition memory performance: acquisition, the amount of information that enters the memory system, and forgetting rate, the continuous decay of information from memory as a function of time or intervening information to be remembered. The forgetting rate, as discussed earlier in the model of Atkinson and Shiffrin (1968), is considered to be a structural feature of memory; acquisition is more variable, and is considered to be a function of many factors such as the type of stimulus encoding and perceptual set.

Developmental studies of recognition memory, as opposed to recall, have been most often characterized by a lack of age-related trends in performance. In her recent review, Brown (1975) has suggested that such invariance with age is probably a function of the degree to which the recognition memory task does not require active retrieval or acquisition strategies. Furthermore, invariant forgetting rates seem to be responsible for the lack of age-related changes in recognition memory performance, as has been shown in a variety of studies where

forgetting rates exhibit little age-related change for either words (e.g., Wickelgren, 1975) or pictures (e.g., Nelson, 1971).

In Experiment II, two main questions were asked: (1) To what degree is rate of forgetting a structural universal, varying little by age or experience?; and (2) To what degree can we specify the nature of variation in rate of acquisition?

The same subjects as in Experiment I were tested on a modified version of the continuous recognition memory task of Shepard and Teghtsoonian (1961). The stimuli were 207 black and white photographs of Middle-Eastern rugs. The experiment consisted of a practice test of 30 trials, followed by the experimental task of 177 trials. The experimental task consisted of 88 different rug patterns and 88 exact duplicates, which were arranged in a sequential array so that duplicates occurred at varying intervals or lags of 1, 5, 10 and 25 intervening items. There were 22 repetitions at each of these four lags, which were distributed as evenly as possible over the entire sequence of items.

As in the first experiment, each subject was tested individually, and was allowed to go on to the experimental task only if he could master the practice task. For both the practice and experimental tasks, the subject was instructed that each rug pattern would have one and only one duplicate or "sister" rug. He should look at each rug carefully, and say whether the present rug design was appearing for the first or second time. The subject was allowed about five seconds to look and respond to each item before turning to the second item.

The results of this continuous recognition memory task were based on five derived measures of performance: total correct (the sum of hits and correct rejections for each subject); and d' (an unbiased measure of memory trace) for each lag (1, 5, 10 or 25 intervening items). For each of these measures, three-way analyses of variance, by age (4) X school (2) X environment (2), were performed. The most important features of the analyses may be summarized as follows:

1. Chronological age produced little or no reliable effects for the various recognition measures.

2. Schooling produced significantly increased performance for the longer lags (10 and 25 intervening items), which resulted in a significant schooling effect for total correct.

3. The effect of environment was highly significant. Contrary to the findings in the short-term recall task, the rural subjects, whether schooled or non-schooled, performed significantly better than their urban counterparts on all recognition measures.

Forgetting rates--or the decrease in d' over lag or delay--proved to be expecially interesting. Statistical profile analyses were performed within each of the groups, and indicated that the forgetting curves were generally invariant or parallel to one another across ages. Since there were essentially no age differences in forgetting rates, these data were pooled across ages and were compared, as single groups, with the data from the three extra groups (Rug Sellers, Koranic students, and Michigan undergraduates).
Profile analyses of these curves indicated that all but the urban schooled and Michigan students had parallel forgetting curves. These latter groups showed significantly less forgetting over lags, but this difference was small in magnitude.

In general, then, these data on recognition memory support previous research that indicated little age-related change in forgetting rates, and, with only minor exceptions, these forgetting rates were also invariant with respect to schooling and environment.

A number of interesting differences were found in total correct and in the rates of acquisition (i.e. the levels of the forgetting curves). While it is unclear why rural subjects performed better than urban subjects in the recogni-

tion task--but the opposite in the recall task--such findings strongly imply that situational factors such as motivation or comprehension probably played little role in the performance of most subjects. Furthermore, the fact that rural non-schooled subjects performed better than the urban schooled subjects implies that schooled subjects do not necessarily do well as a function of learned test-taking skills. There are, however, a number of theoretical explanations for these differences in the acquisition parameter, and these are probably related to variations in stimulus encoding abilities between groups, as hypothesized earlier. For example, the non-schooled Moroccan rug sellers scored as high or higher than all other Moroccan subjects, whether schooled or non-schooled.

Discussion

In the introduction, models of memory were discussed in terms of both structural features and control processes. It was argued that such structure, if built-in, should be present in all subjects regardless of age or experiential background. Several pieces of evidence seem to support this hypothesis: (a) The recency effect (or short-term store) was found in all groups, regardless of age or background; and (b) forgetting rates were generally invariant across groups.

Developmental research in memory has shown that control processes--such as verbal rehearsal and clustering--improve between the ages of 5 and 15 years. While chronological age or maturation has been said to be the important independent variable in such research, some earlier cross-cultural studies (Cole et al., 1971; Wagner, 1974) have shown that the development of control processes may be dependent in part on formal schooling. Data from the present study adds further support to the hypothesis that experiential factors, such as schooling and living in an urban environment, influence the development of control processes. The

results of the short-term recall experiment showed that the primacy effect occurred only with older schooled subjects, and to some extent by urban non-schooled subjects. These data, probably reflecting the stable use of verbal rehearsal strategies by about age 13, are consistent with data collected among American school children (Hagen, 1971).

There is a variety of evidence that suggests that control processes or mnemonics may be culture-specific--where the "cultures" of both western-style schooling and urban society would be exemplars. Additional evidence is available from other sources: anthropological literature (Yates, 1966); motoric mnemonics of deaf children (Liben & Drury, 1976); and kinesthetic memory aids (Lancy, 1975).

It appears reasonable to conclude that claims such as those quoted earlier from Kagan and Klein (1973)--with respect to an "inherent program" of basic cognitive processes--should be limited to the relatively simple estimates of memory performance they studied. Stated in its strongest form, the present study supports the hypothesis that structural features in memory are universal, while control processes seem to be more culture-specific, or a function of the particular experiences that surround each growing child. While the pattern of results appears to support this hypothesis, it is obviously difficult to claim a completely universal structure of memory, because only certain structural features of memory were studied. Furthermore, although differences in control processes seem to be a function of global lifetime experiences, we are, at present, unable to specify what factors in the school or environment specifically influence the development of such processes. Moreover, we cannot claim that children growing up in some cultures are unable to use certain control processes or that such processes do not exist in come culture, for the present study has dealt only with the kinds of control processes used on specified tasks.

In summarizing the two experiments, it is possible to say that we have provided complementary evidence for current psychological models of memory, by confirming the development, and invariance, of several differing aspects of these models. It is also possible to add memory skills to the growing list of cognitive skills that seem to develop as a function of the schooling experience.

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